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ABSTRACT

A study examined the relationship between defense contracting and vocational education in Illinois. During the study, researchers analyzed data from a variety of national and Illinois state data sources, including the Department of Defense, the Bureau of Labor Statistics, the Illinois Department of Commerce and Community Affairs, the Research and Analysis Division of the Illinois Bureau of Employment Security, and the Illinois Bureau of Budget. Data from these sources indicated that defense contracting amounted to $1.3 billion in 1982. This figure amounted to approximately 10 percent of the state's expenditures or 1 percent of its gross state product for fiscal 1982. Thus, defense spending had a major impact on employment and related training programs in the state. Analyses of the supply and demand that various occupations will encounter due to defense spending were inconclusive because of extraneous factors. The researchers did, however, recommend a close monitoring of the following occupational categories: business and office occupations, assemblers, construction craft workers, mechanics, repairers and installers, and machinists. (Appended to this study are various displays of data concerning defense contract dollar distributions in Illinois for fiscal 1982.) (MN)

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CHAPTER 1
INTRODUCTION

Estimates by the Congressional Budget Office indicate that in 1983 about 210,000 job openings could be created for an additional $10 billion spent on defense purchases from U.S. industry.[1] In 1982, defense purchases from industry in Illinois totaled about $1.3 billion. Using the Congressional Budget Office formula, this could account for about 27,300 openings in Illinois in 1982.

Illinois ranked forty-fifth in per capita expenditures of defense dollars among the fifty states and the District of Columbia in 1982, according to *U.S. News & World Report*.[2] Although relatively low in comparison to other states, these defense dollars have a definite impact on both economy and employment and thus become a factor in vocational education.

In addition to the employment generated by defense procurement, the Department of Defense employs approximately 62,400 civilian and military personnel in Illinois. Nationally, civilians represent about one-fourth of all Department of Defense employment including reserves. (Unless otherwise indicated, all statistics are taken from Department of Defense reports which are discussed in Chapter 2.) The Administration has proposed and is implementing a defense build-up in both armament and manpower over the next few years which is reflected in a growth in proposed expenditures of about 6.9 percent annually from 1984-1988 (inflation adjusted). This planned growth emphasizes purchases of weapons, military construction, and research and development. The increase in defense purchases between 1982 and 1987 is expected to average about 13.7 percent a year. The emphasis, then, is on a better equipped, more efficient, more technological military force.

Even though Illinois benefits from only a small percentage of defense spending (2.07 percent in 1981, according to *Illinois Business*[3]), a Data Resources, Inc., report for the Department of Defense projects an annual average growth of 4.5 percent in defense-related employment in Illinois from 1981 to 1987.[4] This growth would mean that between 1981 and 1987, over 51,000 Illinois jobs would either be created or shifted from production for private consumption to production for defense-related consumption (from 170,300 jobs in 1981 to 221,300 jobs in 1987).

While defense purchasing affects almost all industries and areas of employment, those industries producing defense-related products are more directly affected than others. Table 1 (see page 6) shows those industries most directly affected, the shares of their gross national output induced by defense procurement in 1981, and the projected shares for 1987.

Of these industries, 68 percent (13 of 19) can be classified as high technology industries based on a criterion of professional employment. This criterion requires that scientists, engineers and technicians make up 13.7 percent of the total industry employment.[5]

In both defense-related employment and in direct Department of Defense employment, the emphasis is on skilled occupations. Nationally, defense spending is an important determinant of employment in vocational areas such as engineering technology where 7.8 percent of the jobs are defense related, computer specialities where 8.8 percent of employment is related to defense, and metalworking crafts where 10.6 percent of employment is defined as defense related.

Thus, vocational education does have a stake and a justifiable interest in defense contracting and manpower needs in Illinois. The purpose of this study is to examine the nature of defense contracting in Illinois and its potential impact on vocational education.

This report discusses resources and procedures used in the study and presents significant findings and recommendations. Chapter 2 details resources and procedures used in the study. Chapter 3 presents significant findings in terms of employment impact and a statewide occupational analysis. Chapter 4 presents statistics on defense contracting, and Chapter 5 summarizes the findings and provides recommendations for vocational education program planners.

Table 1
Defense Share of National Industrial Production

Industry	SIC**	Defense Share 1981	1987
* Ammunition	3483	94.37	96.34
* Other Ordnance	3489	84.67	89.61
* Tanks and Tank Components	3795	73.39	81.41
* Complete Guided Missiles	3761	66.60	80.88
* Radio and Television Comm. Equipment	3662	50.64	62.60
Shipbuilding and Repair	3731	54.18	59.43
* Aircraft Engines and Engine Parts	3724, 3764	47.99	59.75
* Small Arms Ammunition	3482	40.46	59.09
* Aircraft Parts and Equipment, N.E.C.	3728, 3769	42.79	54.01
* Engineering and Scientific Instruments	3811	33.56	37.94
* Aircraft	3721	32.30	42.89
Nonferrous Forging	3463	26.75	36.21
* Electronic Components, N.E.C.	3675—3679	19.48	25.69
Explosives	2892	19.23	24.83
Industrial Trucks and Tractors	3537	18.18	20.56
Nonferrous Casting, N.E.C.	3369	15.96	21.95
* Small Arms	3484	15.64	24.52
* Semiconductors	3674	13.66	18.14
Truck and Bus Bodies	3713	10.66	16.41

* High Technology Industry
** Standard Industrial Classification Code

CHAPTER 2
RESOURCES AND PROCEDURES

Resources

This section describes the primary resources used in conducting the study. National data were acquired from the Department of Defense and the Bureau of Labor Statistics. Illinois data were provided by the Illinois Department of Commerce and Community Affairs; the Research and Analysis Division of the Illinois Bureau of Employment Security; and the Illinois Bureau of the Budget. In addition, information compiled by the Illinois Occupational Information Coordinating Committee from various national and state data sources was used.

Employment Resources

A variety of employment data, both for Illinois and the nation, were used in developing assumptions about defense procurement implications for Illinois. Specific resources are discussed in the following paragraphs.

• **Defense Economic Impact Modeling System** (1983). The Defense Economic Impact Modeling System (DEIMS), developed by the Department of Defense, is a large integrated economic modeling system designed to serve three basic purposes:

- to analyze the impact of defense expenditures on the United States economy using a consistent and reliable framework of economic models and government policy assumptions;
- to provide planning information on defense requirements to private sector firms in order to alert these companies to sales opportunities as well as to encourage them to increase capacity where needed; and
- to allow the Department of Defense to analyze the impact of alternative defense budgets on key industrial sectors, skilled labor categories, and raw material requirements.

This model provides estimates of the national impact of defense expenditures on industrial employment and occupational employment for the years 1982 through 1987.

Employment estimates for the years 1982 to 1987 are provided for a total of 63 occupational categories and subcategories. Growth percentages were developed in light of projected defense procurement as well as economic development.

• **Occupational Outlook Information Report, State of Illinois, 1976-85** (1981). The *Occupational Outlook Information Report* (OOIR) presents projections to 1985 based on 1970 census data for Illinois. Projections are based on economic conditions and projected changes. Intermediate statistics (i.e., for 1982) are based on the projected trend from 1976 to 1985.

• **The National Industry-Occupation Employment Matrix, 1970, 1978, and Projected 1990** (1981). *The National Industry-Occupation Employment Matrix* is also based on 1970 data. Statistics were updated to 1978 based on industry staffing patterns in 1978. Projections for 1990 were then developed based on a series of economic assumptions for that time period.

In many cases the growth projections from these various sources differ significantly. Table 2 (see page 8) shows average annual growth percentages for thirteen occupational categories as projected by the DEIMS, the Bureau of Labor Statistics (National) and the OOIR (Illinois). Note that the individual projections do not cover exactly the same time period.

Table 2
Differing Levels of PROJECTED GROWTH for Selected Occupational Areas

	DEIMS 82-87	National 78-90	Illinois 76-85
Engineering Science Technicians	2.63	2.36	1.34
Nurses, Professional	3.74	3.78	2.20
Technicians, Exc Health	1.74	2.63	1.83
Computer Specialists	5.21	2.57	.91
Clerical Workers	2.09	2.37	2.04
Construction Craft Workers	1.94	1.60	1.34
Mechanics, Repairers and Installers	2.26	2.48	1.43
Metalworking Crafts Workers	1.99	1.82	1.32
Printing Trade and Craft Workers	.12	-0-	– 1.16
Blue Collar Worker Supervisors	1.84	1.27	1.51
Assemblers	2.49	3.57	3.18
Metalworking Operatives	2.45	1.61	1.54
Service Workers	1.62	2.49	1.50

• **Regional Occupation Planning and Evaluation System** (1983). The Regional Occupation Planning and Evaluation System (ROPES), provides estimates for 1980 and forecasts to 1987 of total employment for 163 occupations in 82 industries by state and for each of 70 major cities. It has many similarities to the Defense Economic Impact Modeling System and focuses on the concern for an adequate supply of skilled manpower.

In comparing ROPES estimates for 1981 to Illinois estimates for 1981, several large discrepancies were found. ROPES estimates are based on national industry staffing patterns and county business patterns while Illinois estimates are based on 1976 staffing patterns in Illinois.

Table 3 compares ROPES figures to Illinois estimates for the thirteen occupational categories. In all but one cluster (assemblers), ROPES growth projections were higher than the Illinois estimates.

Table 3
Comparison of ROPES and Illinois 1981 Employment Estimates

	ROPES 81	Illinois 81	% Difference
Engineering, Science Technicians	56,800	48,801	– 14.08
Nurses, Professional	58,400	51,036	– 12.61
Technicians, Exc Health	10,900	9,352	– 14.20
Computer Specialists	21,400	21,974	2.68
Clerical Workers	959,900	1,054,390	9.84
Construction Craft Workers	127,800	166,052	29.93
Mechanics, Repairers and Installers	162,000	166,489	2.77
Metalworking Crafts Workers	57,700	86,500	49.91
Printing Trade and Craft Workers	28,800	30,936	7.42
Blue Collar Worker Supervisors	64,300	91,182	41.81
Assemblers	98,800	96,591	– 2.24
Metalworking Operatives	116,400	106,534	– 8.48
Service Workers	691,600	635,500	– 8.11

• **The Census of Population and Housing 1980** (1982). This special report provides detailed occupational statistics by Standard Occupational Classification (SOC) Code for Illinois. There are 514 categories reported for Illinois, all counties, all Standard Metropolitan Statistical Areas (SMSA) and cities over 50,000.

There are also differences between 1980 Census figures and both Illinois and ROPES estimates. For example, while ROPES and OOIR report estimates of 1980 employment for Service Workers at 691,600 and 635,500 respectively, Census data indicate a total of 685,603 workers in this category. Differences for some individual occupations

are even more striking. The ROPES employment estimate for electrical and electronic technicians in 1981 is 17,500, while the OOIR estimate is 5,890 and the census figure for 1980 is 10,878. These differences may partially be explained by differences in the occupational coding bases as well as the fact that the Census figures represent both employed and unemployed persons.

Industry Resources

A key factor in the analysis of defense impact on employment is the industries represented in defense procurement in Illinois and the relative share of a specific occupation in a given industry. The Department of Defense (DOD) maintains a Defense Acquisition Management Data System. The 1982 data tape was secured from DOD for this study.

This data tape provides a listing of all procurement contracts for Illinois for FY'82. Data includes the contractor name, city and county code, D-U-N-S (Data Universal Numbering System) number, and the amount and nature of the contract.

An important resource for industry information was a data type leased from Dun and Bradstreet by the Department of Commerce and Community Affairs. This data base includes the D-U-N-S numbers, geographic codes, business names, employment levels and Standard Industrial Classification (SIC) codes for over 240,000 businesses in Illinois.

A computer report, Employment by Industry and Occupation, prepared by the Chicago Area Geographic Information Study (CAGIS) for the Illinois Department of Commerce and Community Affairs, ranks occupations by relative share of employment for industries within three-digit SIC categories. Projected national change between 1980 and 1990 is reported and occupations are coded for three criteria; (1) the occupation represents 0.5 percent or more of industry employment, (2) employment in the industry represents 5 percent or more of total occupational employment, and (3) growth for the occupation is 60 percent or more. Industries in SIC codes 200 and 300 are included in this report.

Procedures

In order to develop estimates of potential defense-induced skilled manpower demand in Illinois, several factors need to be considered. They include the relative mix of current defense expenditures in Illinois, key industry staffing patterns, and projected employment trends both for Illinois and the nation.

Supplied with the information from the Department of Defense reviewed earlier in this chapter, two procedures were used to develop estimates of defense-related demand for skilled workers in Illinois. A total of thirteen occupational areas with fifty subcategories and 1,875 defense contracts for fiscal year 1982 were examined. The resulting data were compared to the ROPES estimates for Illinois developed for the Department of Defense by Data Resources, Inc.

Determining Employment Impact

Analysis of the potential impact of defense contracting in Illinois for the thirteen occupational areas and fifty subcategories was based on Illinois estimates taken from the *Occupational Outlook Information Report* (OOIR) and growth projections from the Defense Economic Impact Modeling System (DEIMS).

Only occupations having a direct match by job title were included. In some cases the DEIMS report included refinements of occupational categories not available in the Illinois report. In these instances, no data were included in the study.

Estimates of employment for 1982 were taken directly from the OOIR. Estimates of employment for 1987 were developed by applying the average annual growth percentage for the period 1982 to 1987 from the DEIMS report to the 1982 Illinois figures. This growth percentage was developed in light of projected defense procurement as well as economic conditions. Estimates of employment change from 1982 to 1987 were derived by subtracting 1982 figures from 1987 figures.

The percent of change induced by defense expenditures (Defense Percent) was derived from DEIMS data using the following formula where DIE is Defense Induced Employment and TE is Total Employment:

$$\text{Defense Percent} = \frac{\text{DIE 87} - \text{DIE 82}}{\text{TE 87} - \text{TE 82}}$$

The (defense) Impact Number reflects the number of new jobs dependent on defense expenditures and was calculated by multiplying the percent of change induced by defense spending (Defense Percent) times the employment change estimate.

Analyzing Defense Contracts

Procurement databases were obtained from the Department of Defense for fiscal years 1981 and 1982. These databases were simple data entries that tracked expenditures on each defense contract greater than $10,000. Various computer sorts of these databases enabled the establishment of an Illinois database containing contractor name, address, type of contract and amount. In order to examine the relationships between defense contracts and industry employment, the Dun and Bradstreet database and the Department of Defense database were merged. This merge resulted in a reassignment of only 50 percent of defense contracts to SIC codes. Therefore, the decision was made to use Defense Related Industry (DRI) codes to analyze defense-related employment.

Once a working database was established, various sorting runs were made to provide analyses by county, by city, by contractor, by dollar amount and by DUNS number (See Appendices A, B and C). Additional calculations were made to examine the impact of defense spending on occupations by vocational education regions. Charts presenting these analyses are included in Appendix E.

Regional Impacts

Included in Appendix B is a breakdown of defense contract dollars by Defense Related Industry codes and Vocational Education Regions. Examination of this report revealed the specific types of defense-related industries that are concentrated in each region. Once these industries were identified, DEIMS data were referenced to identify occupations concentrated in these industries. County distribution of significant defense-related industries by Federal supply codes may be found in Appendix C. Regional demand was calculated by multiplying the regional share of defense dollars for the industries affecting each occupation by the statewide occupational impact figures found in Table 4 (see pages 11-12). Further analysis was performed by crossing the significant occupations with related United States Office of Education (O.E.) programs and aggregating the total number of completers for all related O.E. programs. While other sources of supply such as occupational transfers and private post secondary completers were not included in these supply estimates, this approach allowed summary conclusions about the adequacy of vocational program supply for defense-impacted occupations in each region to be developed.

CHAPTER 3
EMPLOYMENT IMPACT OF DEFENSE PROCUREMENT

The employment impact of defense procurement has been examined on a national basis from a variety of perspectives. The Defense Economic Impact Modeling System (DEIMS) projects the impact of defense spending on occupational employment for the years 1982 through 1987. A second study, the Regional Occupational Planning and Evaluation System (ROPES), attempts to define the regional impact of defense spending on employment by state and large Standard Metropolitan Statistical Areas (SMSA).

Based on these studies, thirteen occupational areas were identified as pertinent to vocational education at either the secondary or the postsecondary level or both. The potential employment impact of defense procurement for these areas and selected subcategories was determined by applying DEIMS growth projections to Illinois employment estimates taken from the *Occupational Outlook Information Report* (OOIR).

Projected defense procurement impact is shown in Table 4. The column labeled "1982" represents figures taken from the OOIR. The column labeled "1987" shows the results of the calculations based on DEIMS projections. Defense Percent is the percent of growth that is expected to be defense induced and was also calculated from DEIMS projections. The Impact Number is derived by applying the Defense Percent to the Employment Change for each occupation. The Impact Number should be viewed as a multi-year statistic that must be further divided (by five) to reflect demand on an annual basis derived from defense spending only.

Table 4
Potential Impact of Defense Contracting on Selected Illinois Occupations
Estimates Based on DEIMS Projections

	Estimates of Employment			Defense	Impact
	1982	1987	Change	Percent	Number
Engineering and Science Technicians	49402	55898	6496	23.06	1497
Civil Engineering Technicians	1097	1237	140	1.08	1
Drafters	24580	28107	3527	16.62	586
Electrical and Electronic Tech.	5968	6955	987	25.30	249
Industrial Engineering Tech.	1276	1434	158	32.07	50
Mechanical Engineering Tech.	494	570	76	62.07	47
Other Engineering Technicians	15987	17473	1486	21.08	313
Nurses, Professional	52053	61786	9733	1.32	128
Technicians Exc. Health, Sci. & Eng.	9507	10334	827	17.93	148
Airplane Pilots & Flight Eng.	3849	4299	450	18.53	83
Air Traffic Controllers	1440	1574	134	0.89	1
Radio Operators	2003	2116	113	7.41	8
Tool Programmers-Numerical	336	373	37	51.64	19
Other Technicians	1879	2043	164	23.73	38
Computer Specialists	22165	27938	5773	16.20	935
Computer Programmers	12934	15934	3000	17.47	524
Computer Systems Analysts	8183	10641	2458	14.83	364
Clerical Workers	1073887	1186108	112221	8.71	9774
Computer & Peripheral Equip. Oper.	18206	23394	5188	8.95	464
Secretaries, Typists & Other Office Machine Operators	342199	378643	36444	9.74	3549
Other Clerical Workers	713482	785900	72418	8.20	5938
Construction Craft Workers	168168	184143	15975	16.60	2651
Electricians	34736	37862	3126	22.45	701
Plumbers and Pipefitters	25245	27807	2562	18.29	468
Structural Steel Workers	5842	6356	514	21.52	110
Other Construction Craft Workers	102345	112118	9773	14.44	1411

Table 4 (continued)

	Estimates of Employment 1982	1987	Change	Defense Percent	Impact Number
Mechanics, Repairers and Installers	192048	213749	21701	10.64	2308
Aircraft Mechanics	2388	2656	268	45.50	121
Auto Mechanics and Repairers	57696	65196	7500	4.88	366
Data Processing Machine Repairers	3149	4347	1198	4.39	52
Millwrights	6088	6672	584	27.83	162
Telephone Installers & Repairers	15273	16342	1069	9.97	106
Other Mech., Rep. & Installers	107454	117500	10046	10.89	1094
Metalworking Craft Workers	81461	89566	8105	32.98	2673
Blacksmiths	435	466	31	26.19	8
Boilermakers	2440	2618	178	21.52	38
Forging Press Operators	2146	2394	248	47.87	118
Heat Treaters, Annealers	2099	2335	236	41.15	97
Machine Tool Setters, Metalwork	12958	14545	1587	41.49	658
Machinists	25313	28148	2835	26.30	745
Molders, Metal	4651	4913	262	51.58	135
Patternmakers, Metal	2614	2897	283	51.28	145
Rolling Mill Operators	1876	2021	145	44.44	64
Sheetmetal Workers	9599	10458	859	33.31	286
Tool and Diemakers	17330	19028	1698	39.30	667
Printing Trade and Craft Workers	30546	30729	183	127.85	233
Blue Collar Worker Supervisors	92461	100967	8506	22.22	1890
Assemblers	99261	111618	12357	45.57	5631
Metalworking Operatives	106513	119560	13047	34.76	4535
Drill Press Operatives	6599	7453	854	34.76	296
Electroplaters	2983	3351	368	48.99	180
Grinding Machine Operatives	9462	10668	1206	34.99	421
Heaters, Metal	524	575	51	43.86	22
Lathe, Milling Machine Operatives	10163	11524	1361	36.51	496
Punch Press Operators, Metal	19344	21375	2031	27.01	548
Welders and Flamecutters	43864	49127	5263	21.96	1155
Other Metalworking Operatives	7802	8621	819	41.44	339
Service Workers	644438	701792	57354	7.54	4324
Food Service Workers	217717	237093	19376	11.44	2216
Health Service Workers	106294	127340	21046	1.12	235
Protective Service Workers	76153	82549	6396	10.93	699
Other Service Workers	244274	265525	21251	7.62	1619

Engineering and Science Technicians

In the five year period between 1982 and 1987, employment of engineering and science technicians in Illinois is expected to increase by nearly 6,500 jobs. Of these, approximately 1,500 are expected to occur as a result of defense procurement. ROPES projections indicate that over 70 percent of this growth will be in Region 1.

The occupation *drafter,* which represents over one-half of this occupational cluster, also accounts for the largest projected growth in employment both for total employment (approximately 3,500) and for defense-induced employment (almost 600). A comparison of Illinois and national employment data indicates that drafters are somewhat over-represented in the Illinois employment base. While Illinois employment represents about 5.13 percent of all employment, the number of drafters employed in Illinois in 1978 (about 22,900) was about 7.74 percent of the total number of drafters nationally (296,000).

The occupations *electrical and electronic technicians, industrial engineering technicians* and *mechanical engineering technicians* are projected to be more highly affected by defense procurement than the engineering and science technicians cluster in general. Other sources indicate that the growth for electrical and electronic technicians may be underestimated. ROPES data, for example, project 19,000 jobs will exist for electrical and electronic technicians by 1987 based on an employment estimate of 17,500 in 1981 while Illinois data estimates employment of less than 6,000 in 1982.

As over one-fifth of the growth in engineering and science technicians' employment in Illinois is anticipated to be due to defense procurement, any significant change in defense procurement in Illinois would impact on employment demand in this area. Industries of particular interest include Radio, TV and Communications Equipment; Aircraft and Parts; Ordnance and Accessories; Electronic Components and Accessories; Instruments and Supplies and Business Services. Taken together, these industries represent over 50 percent of all defense-induced employment among engineering and science technicians. (See Table 5, p. 13.)

Table 5
Estimated Percentage of Defense-Induced Employment for Engineering and Science Technicians by Industry

DRI	Industry	1982	1987
56	Radio, TV and Communications Equipment	17.70	19.61
60	Aircraft and Parts	12.20	13.40
13	Ordnance and Accessories	8.07	8.77
57	Electronic Components and Accessories	6.14	7.83
62	Instruments and Supplies	3.11	3.40
73	Business Services	2.92	3.29
	Total	**50.15**	**56.31**

By and large, employers prefer applicants for these jobs who have had some specialized technical training. Nationally, nearly one-half of those who took jobs in this field had some postsecondary education. The need to replace experienced technicians who move to other jobs or stop working is expected to account for about 85 percent of all job openings while growth will account for the remaining 15 percent.

Professional Nurses
While it is anticipated that almost 10,000 new nursing positions will occur between 1982 and 1987 in Illinois, the impact of defense procurement on this occupation will be relatively low. Replacement needs are expected to account for about 75 percent of all job openings with growth representing the remaining 25 percent. Advances in medical technology which call for more highly skilled health workers should increase demand.

Technicians, Except Health, Science and Engineering
A relatively small net growth (just over 800 new jobs) is anticipated in this area. The largest defense impact is expected to be on the occupation *numerical tool programmer* where over one-half of the growth (51.64 percent) is projected to be defense induced. Employment levels of tool programmers would be affected by significant contracts with Aircraft and Parts; Ordnance and Accessories; and Radio, TV and Communications Equipment industries which represent about two-thirds of the defense-induced employment for tool programmers.

Computer Specialists
Projected growth over the five years studied is just under 6,000 jobs. Defense procurement is expected to account for about one-sixth of these new jobs at slightly less than 1,000 positions.

Many employers prefer college graduates for computer programming positions, particularly for scientific or engineering applications. Generally, graduates of two-year programs are hired for business applications. For systems analysts, a four-year degree is usually necessary. Not all programmers or systems analysts come from the ranks of those who hold degrees in computer programming. High wages and shortages attract workers from related disciplines.

Replacement is expected to be responsible for about two-thirds of the job openings for programmers and about one-half of the need for systems analysts.

Clerical Workers
Employment growth in this area is projected to be over 112,000 between 1982 and 1987. Defense impact, at less than 9 percent, represents about 10,000 of these new positions. A large number of job titles are included in this very broad area which represents over 20 percent of the Illinois workforce.

High school graduation with appropriate vocational courses is generally required for employment in these areas. Employment occurs across all industries.

Construction Craft Workers
Employment of construction craft workers is expected to increase by almost 16,000 in the five-year period under study. Defense procurement is projected to account for about one-sixth of this increase (16.60 percent). Over one-fifth of new jobs for electricians and structural steel workers are anticipated to be defense induced. New construction is expected to account for about one-third of defense-induced employment and somewhat less than one-half of all employment for construction craft workers.

Replacement needs are expected to account for about 80 percent of the demand for electricians and sheetmetal workers and about 90 percent of the demand for plumbers and pipefitters.

Mechanics, Repairers and Installers
The projected growth for mechanics, repairers and installers from 1982 to 1987 in Illinois totals almost 22,000 jobs. Slightly over 10 percent of this growth is anticipated to be due to defense procurement. Over one-fourth of the growth for millwrights and almost one-half of the growth for aircraft mechanics is expected to occur as result of defense contracting. Industries of interest for this area include Aircraft and Parts, Wholesale and Retail Trade, Transportation and Warehousing, and Communications, Except Radio and TV. Taken together, they represent about 20 percent of the defense-induced employment for mechanics, repairers and installers. (See Table 6.)

Table 6
Estimated Percentage of Defense Induced Employment for Mechanics, Repairers and Installers

DRI	Industry	1982	1987
60	Aircraft and Parts	6.17	7.72
69	Wholesale and Retail Trade	3.17	4.21
65	Transportation and Warehousing	4.04	4.19
66	Communications, Except Radio & TV	3.96	4.09
	Total	**17.31**	**20.21**

Metalworking Craft Workers
A projected growth of about 8,000 new jobs in the five-year period from 1982 to 1987 is heavily influenced by anticipated defense procurement with almost one-third of this growth attributed to defense. This occupational cluster is somewhat overrepresented in the Illinois employment base as compared to national employment. Of the approximately 1,200,000 metalworking craft workers nationally in 1978, about 83,300, or 6.94 percent, were in Illinois. This compares to an average of 5.13 percent for all occupations.

Thus, the effects of defense procurement on metalworking crafts in Illinois are multiplied by the larger share of employment in this occupational area as well as the relatively large proportion of job growth attributed to defense.

Industries of particular interest include Aircraft and Parts; Radio, TV and Communications Equipment; Other Transportation Equipment; Ordnance and Accessories; New Construction; Metalworking Machines and Equipment and Primary Ferrous Metals. Together, these industries are expected to account for over two-fifths of the defense-induced employment in metalworking crafts. (See Table 7.)

Table 7
Estimated Percentage of Defense Induced Employment for Metalworking Craft Workers

DRI	Industry	1982	1987
60	Aircraft and Parts	14.48	16.49
56	Radio, TV and Communications Equipment	5.66	5.95
61	Other Transportation Equipment	4.81	4.29
13	Ordnance and Accessories	4.79	5.25
11	New Construction	4.30	4.79
47	Metalworking Machines and Equipment	3.53	4.15
37	Primary Ferrous Metals	3.44	3.64
	Total	**41.01**	**44.56**

Printing Trade and Craft Workers
While the anticipated number of new jobs in this area is expected to be very small (less than 200 over the five years covered), the impact of defense procurement is expected to compensate for what would otherwise be a net loss in jobs. Of primary interest are contracts within the Printing and Publishing industry in Illinois.

Blue Collar Worker Supervisors
Of the five-year anticipated growth of over 8,000 jobs for blue collar worker supervisors, more than one-fifth are projected to occur as the result of defense procurement. About 55 percent of the defense-induced employment for blue collar worker supervisors is shared by the eight industries shown in Table 8 with the Aircraft and Parts industry responsible for about one-sixth of defense-induced employment for this group of workers. (See Table 8, p. 15.)

Table 8
Estimated Percentage of Defense-Induced Employment for Blue Collar Worker Supervisors

DRI	Industry	1982	1987
60	Aircraft and Parts	16.18	15.96
56	Radio, TV and Communications Equipment	9.87	10.14
13	Ordnance and Accessories	7.57	7.70
61	Other Transportation Equipment	5.64	4.65
57	Electronic Components and Accessories	4.67	5.60
65	Transportation and Warehousing	4.51	3.82
37	Primary Ferrous Metals	4.34	4.38
11	New Construction	3.62	3.96
	Total	**56.40**	**56.22**

The level of technological skill required for this job in the industries affected indicates the need for vocational training beyond the secondary school level.

Assemblers

Defense impact for this group of occupations accounts for over 45 percent of the projected growth of more than 12,000 jobs between 1982 and 1987. Five high technology industries account for over 78 percent of all of the projected defense-induced employment growth in this occupational field. (See Table 9.)

Table 9
Estimated Percentage of Defense Induced Employment for Assemblers

DRI	Industry	1982	1987
56	Radio, TV and Communications Equipment	26.64	25.09
57	Electronic Components and Accessories	17.23	19.26
60	Aircraft and Parts	15.10	14.86
13	Ordnance and Accessories	12.15	11.98
62	Instruments and Supplies	7.65	7.43
	Total	**78.78**	**78.62**

Metalworking Operatives

Over 13,000 new jobs are projected for the period between 1982 and 1987 for metalworking operatives. As with metalworking craft workers, this occupation is expected to be significantly affected by defense procurement with the anticipation that almost 35 percent of the projected growth will be defense induced. This is also an area where Illinois has a larger than average share of workers with about 102,000 workers in Illinois, which is about 7.29 percent of the national estimate of 1,399,500 for 1978. As noted earlier, the average for Illinois for all occupations is 5.13 percent.

Defense contracts with industries such as Aircraft and Parts, Other Transportation Equipment, and Ordnance and Accessories are of particular interest in this area. (See Table 10.)

Table 10
Estimated Percentage of Defense-Induced Employment for Metalworking Operatives

DRI	Industry	1982	1987
60	Aircraft and Parts	20.85	21.65
61	Other Transportation Equipment	10.31	8.36
13	Ordnance and Accessories	8.76	8.94
	Total	**39.92**	**38.95**

Service Workers
It is projected that there will be about 57,000 new jobs in this area between 1982 and 1987. Defense procurement is expected to account for about 7.54 percent of the employment growth with higher impact on occupations in food service and protective service. Expansion of existing military facilities or growth in military population in Illinois would influence growth in this area.

Summary
Occupational areas most highly impacted by defense expenditures are Engineering and Science Technicians, Metalworking Craft Workers, Printing Trade and Craft Workers, Blue Collar Worker Supervisors, Assemblers and Metalworking Operatives.

Several of the selected occupations, particularly in metalworking, have a significantly larger portion of the national labor market than the Illinois average. (Average for all occupations is 5.13 percent.)

Illinois Labor Market Share

Skilled Occupations	% of National
Drafters	7.73
Tool Programmers, Numerical	7.49
Heat Treaters and Annealers	9.53
Forge and Hammer Operators	10.47
Job and Die Setters, Metal	12.04
Molders	8.39
Pattern and Modelmakers	7.68
Rollers and Finishers	7.88
Tool and Die Makers	9.69
Printing Trade and Craft Workers	7.54
Semi-Skilled Occupations	
Drill Press Operatives	10.52
Grinding Machine Operatives	7.48
Heaters, Metal	7.91
Lathe, Milling Machine Operatives	7.48
Metal Platers	7.27
Other Precision Machine Operatives	7.05
Punch, Stamping Press Operatives	10.43
Other Metalworking Operatives	8.16

CHAPTER 4
DEFENSE CONTRACTING

Defense contracting in the State of Illinois amounted to $1.3 billion in 1982. Sixty percent of that amount was located in Region 1, sixteen percent in Region 2, four percent in Region 3, five percent in Region 4, thirteen percent in Region 5, and two percent in Region 6 (see map in Appendix F). The actual distribution of contract dollars by defense-related industry codes can be found in Table 11. This table also gives each industry's proportion of contract dollars in each region and each region's proportion of the state's contract dollars for each industry.

The top ten industries for the State of Illinois are Radio and TV Communications Equipment with 13.2 percent of the total defense dollars; Aircraft and Parts with 9.7 percent; Food and Kindred Products with 9.6 percent; New Construction with 9.1 percent; Materials Handling and Heavy Equipment with 5.5 percent; Health, Education, and Social Services with 4.9 percent; Petroleum and Coal Products with 3.7 percent; Miscellaneous Business and Professional Services with 3.4 percent; and Electrical Equipment with 2.4 percent. These contracts reflect the general industrial makeup of the state with the greatest concentration occuring in Region 1.

Appendix E presents the distribution of contract dollars and percentages as they apply to specific impact occupations. This table was calculated by summing the industry contract dollars for all the industries in which defense spending will have an impact on a given occupation. This process was repeated for the state and each of the vocational education regions. The regions' percentages of the state totals were then calculated for each occupation. These percentages were used to derive the regional defense related impact numbers but may be of some significance in themselves.

Table 11
FY82 Defense Related Industry
Contract Dollars by Proportion of
Total Defense and Proportion by Region

DRI	Total Dollars	REGIONS 1	2	3	4	5	6
03 Crops Agriculture	$164,000	$164,000 .0002/1.00					
09 Stone/Clay Mining and Quarrying	158,000	158,000 .0004/1.00					
11 Construction, New	122,114,000	16,724,000 .02/.14	10,486,000 .05/.09	1,763,000 .04/.01	13,901,000 .19/.11	68,841,000 .405/.56	10,399,000 .35/.09
12 Construction, Maintenance and Repair	31,217,000	2,215,000 .003/.07	8,878,000 .04/.28	412,000 .009/.01	7,229,000 .10/.23	12,370,000 .07/.40	113,000 .004/.004
13 Ordnance and Accessories	41,995,000	12,667,000 .02/.30	686,000 .003/.01		2,015,000 .03/.05	24,739,000 .15/.59	1,888,000 .06/.05
14 Food and Kindred Products	129,243,000	116,296,000 .14/.90	4,753,000 .02/.04	2,103,000 .04/.02	5,279,000 .07/.04	812,000 .005/.006	
17 Floor Coverings and Miscellaneous Textile Products	107,000	107,000 .0001/1.00					

Table 11 (continued)

DRI	Total Dollars	REGIONS 1	2	3	4	5	6
18 Tire Cord and Fabric and Textile Goods, N.E.C.	2,890,000	2,890,000 .004/1.00					
19 Apparel and Other Finished Fabric Goods	11,974,000	1,967,000 .002/.16		828,000 .02/.07	617,000 .008/.05	3,850,000 .02/.32	4,712,000 .16/.39
20 Lumber and Wood Products	109,000	109,000 .0001/1.00					
22 Household Furniture and Fixtures	10,491,000	10,491,000 .01/1.00					
23 Office and Store Furniture Fixtures	4,272,000	3,931,000 .005/.92		148,000 .003/.03	193,000 .003/.05		
25 Paper and Allied Products	6,256,000	5,840,000 .007/.93	284,000 .001/.05				132,000 .004/.02
26 Printing and Publishing	3,289,000	2,999,000 .004/.91		290,000 .006/.09			
27 Industrial and Agricultural Chemicals	15,584,000	1,703,000 .002/.11	3,502,000 .02/.22	285,000 .006/.02	421,000 .006/.03	4,837,000 .03/.31	4,836,000 .16/.31
28 Plastics Materials and Synthetic Resins, Rubber, and Other Man Made Fibers	388,000	388,000 .0005/1.00					
29 Drugs and Soaps	10,873,000	10,212,000 .01/.94			248,000 .003/.02	413,000 .002/.04	
30 Paints	592,000	592,000 .0007/1.00					
31 Petroleum and Coal Products	49,984,000	45,181,000 .06/.90	452,000 .002/.01	499,000 .01/.01	929,000 .01/.02	1,131,000 .007/.02	1,792,000 .06/.04
32 Rubber and Plastics Products, N.E.C.	3,165,000	413,000 .0005/.13			2,019,000 .03/.64		733,000 .02/.23
33 Hose and Belting	1,383,000	789,000 .001/.57		594,000 .01/.43			
34 Leather and Leather Products	12,701,000	125,000 .0002/.01	112,000 .0005/.01			12,464,000 .07/.98	

Table 11 (continued)

DRI	Total Dollars	REGIONS 1	2	3	4	5	6
35 Glass Products	377,000					377,000 .002/1.00	
36 Stone and Clay Products	4,228,000	4,037,000 .005/.95	191,000 .0009/.05				
37 Blast Furnaces, Steel Works, Rolling Mills, and Iron and Steel Foundaries	1,564,000	1,261,000 .002/.81	303,000 .001/.19				
38 Secondary Smelting, Refining, Rolling, Drawing and Extruding of Nonferrous Metals	2,800,000	2,645,000 .003/.95				155,000 .0003/.55	
39 Metal Cans, Shipping Containers and Sanitary Ware	677,000	677,000 .0008/1.00					
40 Heating Equipment, Plumbing Fixtures and Fabricated Structural Metal Products	4,190,000	3,253,000 .004/.78	501,000 .002/.12			436,000 .003/.10	
41 Screw Machine and Metal Stamping Products	1,241,000	949,000 .001/.76	292,000 .001/.24				
42 Cutlery, Hand Tools and General Hardware, Coating and Engraving, and Misc. Fabricated Metal Products	12,005,000	8,097,000 .01/.67	3,785,000 .02/.32		123,000 .002/.01		
43 Engines and Turbines	17,147,000	5,972,000 .007/.35	5,993,000 .03/.35	5,182,000 .11/.30			
44 Farm and Garden Machinery and Equipment	124,000		124,000 .0006/1.00				
45 Construction and Mining Machinery and Equipment	30,745,000	1,320,000 .002/.04	4,508,000 .02/.15	10,895,000 .22/.35	14,022,000 .19/.46		
46 Materials Handling Machinery and Equipment	73,634,000	49,782,000 .06/.676		19,822,000 .41/.269	4,030,000 .05/.055		
47 Metalworking Machinery and Equipment	8,091,000	3,165,000 .004/.39	4,926,000 .02/.609				

Table 11 (continued)

DRI	Total Dollars	REGIONS 1	2	3	4	5	6
48 Special Industry Machinery, Except Metalworking	471,000	143,000 .0002/.30	328,000 /.70				
49 General Industrial Machinery and Equipment	31,723,000	18,051,000 .02/.57	12,793,000 .002/.40	715,000 .01/.02		164,000 .001/.01	
50 Miscellaneous Machinery, Except Electrical	354,000	354,000 .0004/1.00					
51 Office, Computing, and Accounting Machines	3,007,000	3,007,000 .004/1.00					
52 Refrigeration and Service Industry Machinery	8,069,000	4,735,000 .006/.59	1,583,000 .007/.19			1,292,000 .008/.16	459,000 .02/.06
53 Electric Transmission and Distribution Equipment and Electrical Industrial Apparatus	37,846,000	24,128,000 .03/.637	12,131,000 .06/.32	148,000 .003/.0039	632,000 .009/.0167	546,000 .003/.014	261,000 .009/.0069
54 Household Appliances	2,714,000	2,714,000 .003/1.00					
55 Electric Lighting and Wiring Equipment	13,033,000	12,053,000 .01/.9248	350,000 .002/.0269		630,000 .009/.0483		
56 Radio and TV Receiving and Communication Equipment	176,972,000	173,946,000 .22/.9829	838,000 .004/.0047	1,836,000 .04/.0104	128,000 .002/.0007	224,000 .001/.0013	
57 Electronic Components and Accessories	17,450,000	14,861,000 .02/.85	140,000 .0007/.008			2,449,000 .01/.14	
58 Misc. Electrical Machinery, Equipment and Supplies	26,512,000	18,719,000 .02/.71	7,793,000 .04/.29				
59 Motor Vehicles and Motor Vehicle Equipment	17,149,000	13,082,000 .02/.76	775,000 .004/.05	664,000 .01/.04	1,561,000 .02/.09		1,067,000 /.06
60 Aircraft and Parts	130,205,000	11,856,000 .01/.09	106,245,000 .50/.82	105,000 .002/.0008	492,000 .007/.004	10,785,000 .06/.08	722,000 .04/.0055
61 Other Transportation Equipment	29,013,000	28,610,000 .04/.99				403,000 .002/.01	
62 Instruments Except Optical and Photographic	15,741,000	15,031,000 .02/.96	710,000 .003/.04				

Table 11 (continued)

DRI	Total Dollars	REGIONS 1	2	3	4	5	6
63 Optical and Photographic Equipment and Supplies	31,774,000	31,774,000 .04/1.00					
64 Misc. Manufacturing	1,062,000	1,062,000 .001/1.00					
65 Transportation Services	302,000	302,000 .0004/1.00					
66 Communications Services Except Radio and TV	3,551,000	3,045,000 .004/.86	110,000 .0005/.03			396,000 .002/.11	
68 Utilities	13,472,000	2,794,000 .003/.21	2,382,000 .01/.18		3,514,000 .05/.26	4,782,000 .03/.35	
69 Wholesale and Retail Trade	8,080,000	7,907,000 .01/.98					173,000 .006/.02
72 Hotel and Lodging Places, Beauty and Barber Shops, and Misc. Personal Services	485,000	121,000 .001/.25			364,000 .005/.75		
73 Misc. Business and Professional Services and Advertising	46,361,000	20,714,000 .03/.45	11,706,000 .06/.25	275,000 .006/.006	1,704,000 .02/.04	11,436,000 .07/.25	526,000 .02/.01
74 Eating and Drinking Places	1,136,000	656,000 .0008/.58				480,000 .003/.42	
75 Automobile Repair and Services	2,734,000	187,000 .0002/.07			2,547,000 .03/.93		
77 Health, Educational and Social Services and Non-profit	65,740,000	55,989,000 .07/.85	379,000 .002/.006		8,760,000 .12/.13	144,000 .0088/.002	468,000 .02/.007
82 Government	22,351,000	18,171,000 .02/.81				4,180,000 .02/.19	
00 All Other	20,278,000	7,421,000 .009/.37	4,771,000 .02/.24	2,134,000 .04/.10	2,494,000 .04/.12	2,284,000 .01/.11	1,174,000 .04/.06
TOTAL	**1,343,357,000**	**808,552,000**	**212,810,000**	**48,698,000**	**73,852,000**	**169,990,000**	**29,445,000**

CHAPTER 5
RESULTS AND CONCLUSIONS

Analyses of the impact of defense-related spending on vocational education occupations and programs were conducted using selected nationally identified occupations and impact data, Department of Defense contract data, and Vocational Education Data System information. In conducting the analyses the following assumptions were made:

1. Regional demand due to defense spending was calculated by applying the regional proportion of the FY'82 total defense dollars for the industries having impact on each occupation to the statewide occupational impact figures. This method was based on the assumption that while defense funding will increase in Illinois, the allocation by industry within each region will remain constant;

2. Labor market supply was assumed to continue at present levels, with the numbers of completers of vocational programs being held constant for five years (1987); and

3. Defense spending was assumed to maintain the level of spending planned by the present administration for 1982 through 1987.

Regional Analysis

The impact of defense spending on occupations in various regions of the state was estimated by calculating the current amount of funding per region for the industries that were identified in the Defense Economic Impact Modeling System (DEIMS) as those which will influence employment of a given occupation. Those occupations identified in Chapter 3 as having at least 100 job openings in the state between 1982 and 1987 due to defense spending were examined on a regional basis. Appendix E presents a cross tabulation of the distribution of the funding projected to affect each occupation across the six Illinois vocational education regions. (See Appendix F for map of regions.) Each region's percentage of contract dollars was applied to the estimated statewide occupational impact number (Table 4, pages 11-12) to determine an estimate of the impact of defense spending within a region. The estimated occupational impact numbers were then ranked to develop for each region a list of the ten occupations that will be most influenced by the defense spending. Listings for each region follow:

Region 1

Other Clerical Workers;
Assemblers;
Food Service Workers;
Secretaries, Typists and Other Office Machine Operators;
Other Construction Craft Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machinists;
Electricians;
Machine Tool Setters.

Region 2

Assemblers;
Other Clerical Workers;
Secretaries, Typists, and Other Office Machine Operators;
Food Service Workers;
Other Construction Craft Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machine Tool Setters;
Tool and Diemakers;
Punch Press Operators.

Region 3

Assemblers;
Other Clerical Workers;
Other Construction Craft Workers;
Secretaries, Typists and Other Office Machine Operators;
Welders and Flamecutters;
Printing Trades Workers;
Other Mechanics, Repairers and Installers;
Machine Tool Setters;
Tool and Diemakers;
Machinists.

Region 4

Other Clerical Workers;
Secretaries, Typists, and Other Office Machine Operators;
Assemblers;
Food Service Workers;
Other Construction Craft Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machinists;
Electricians;
Drafters.

Region 5

Other Clerical Workers;
Secretaries, Typists, and Other Office Machine Operators;
Assemblers;
Other Construction Craft Workers;
Food Service Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machinists;
Electricians;
Drafters.

Region 6

Other Clerical Workers;
Secretaries, Typists, and Other Office Machine Operators;
Assemblers;
Other Construction Craft Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machinists;
Electricians;
Tool and Diemakers;
Drafters.

An analysis of occupational impact by individual Illinois vocational education regions shows little regional difference in the occupations affected. Examination of the top ten occupations in each region reveals that seven of the occupations are common to all regions. Other Clerical Workers; Assemblers; Secretaries, Typists, and Other Office Machine Operators; Other Construction Workers; Welders and Flamecutters; Other Machine Repairers; and Machinists are among the top ten occupations for each of the six regions.

Two occupational categories, Food Service Workers and Electricians, are in the top ten occupations for four regions. Food service workers are affected in Regions 1, 2, 4, and 5. Electricians are among the affected occupations in Regions 1, 4, 5, and 6. Two additional occupations, Tool and Diemakers and Drafters, are estimated to be influenced by defense spending in three regions: Tool and Diemakers in Regions 2, 3, and 6; Drafters in Regions 4, 5, and 6. Machine Tool Setters are included in the top ten occupations for Regions 1 and 3. Punch and Stamping Press Operators are affected in Region 2 and the Printing Trade and Craft Workers in Region 3.

Relationships between the occupational categories covered by the DEIMS (categories based upon the census classification system) and programs of study (classified by the United States Office of Education (O.E.) taxonomy) are presented in the *Vocational Preparation and Occupations* (VPO) crosswalk tape and publications. The VPO estab-

lishes these relationships through a common link to both occupational and educational program taxonomies, the *Dictionary of Occupational Titles* (DOT) classification system. Appendix D presents a crosswalk of Specific Impact Occupations to Illinois O.E. programs based upon the VPO. The O.E. taxonomy was used in this study as data were not available by the new Classification of Instructional Programs (CIP) System.

An examination of available training programs as reported by the Vocational Education Data System (VEDS) indicated related vocational programs exist for the top ten occupations on each regional list.

Unfortunately, total demand data (nondefense demand and defense-induced demand) for occupations are available only at the state level. Therefore, even though defense impact demand was estimated by region, it was impossible to do a complete supply/demand analysis without the total demand information. Regional vocational education administrators should closely monitor the programs related to the identified defense impact occupations in their regions. Hopefully, regional demand data will be available in the future to allow for more detailed analysis. Additional considerations presented in the discussion of statewide occupational categories in the following section are also applicable to regional analysis.

Statewide Analysis

The top ten defense-impact occupations for the State of Illinois as identified in Chapter 3 are as follows:

Other Clerical Workers;
Assemblers;
Secretaries, Typists, and Other Office Machine Operators;
Food Service Workers;
Other Construction Craft Workers;
Welders and Flamecutters;
Other Mechanics, Repairers and Installers;
Machinists;
Electricians; and
Protective Service Workers.

As Table 4 indicates, projections of employment change for these occupations for the period 1982-87 are provided by the DEIMS. Supply/demand analyses may be made relating these occupations to programs of study and reviewing statistics on program completers.

The crosswalk between Specific Impact Occupations and Illinois O.E. Programs (Appendix D) was used to identify appropriate numbers of program completers through the Vocational Education Data System (VEDS) for comparison with projections of employment change. Brief analyses of these comparisons are presented below.

Other Clerical Workers
This broad category is comprised of a variety of clerical occupations such as bookkeepers, receptionists, and file clerks. VEDS data for the sixteen related programs of study indicate a severe shortage of trained workers for this large occupational area. However, several of the specific titles included in this category require only general preparation with additional instruction occurring on-the-job. In addition, completers of specific clerical programs generally qualify for a variety of clerical occupations, and transfers among occupations within the clerical cluster are common. For these reasons, the supply of workers indicated by VEDS data for this occupational area is likely to be understated.

Assemblers
Twenty different programs are related to this occupation by the VPO. These programs appear to relate to the industrial work setting and clearly supply other occupations within those settings as well. In addition, while employers may require a high school diploma for entry into the occupation, most assemblers are trained informally on the job. For these reasons, a meaningful comparison of supply from related programs and demand was not possible.

Secretaries, Typists, and Other Office Machine Operators
Based upon data from the related programs indicated by the VPO, this occupational area is slightly undersupplied statewide. As indicated previously, occupational transfers within the clerical area are common and completers of one clerical program may effectively supply another clerical occupation. However, when supply and demand for two categories, Other Clerical Workers and Secretaries, Typists, and Other Office Machine Operators, are combined, the statewide outlook still indicates a shortage of trained workers. While clerical training programs provide more than an adequate supply for openings attributed to projected growth (including defense impact) in this field, replacement needs for those workers who die, retire or otherwise leave the labor force are substantial, resulting in a statewide shortage of recent program completers.

Food Service Workers
Food Service Workers include Cooks, Dishwashers and Counter Workers. Training for the majority of these specific occupations occurs on the job. Statewide supply/demand analysis indicates total openings far exceed the number of formally trained workers for this occupational category. However, unless employers begin to require formal training for new entrants into the field, the supply of workers should be adequate.

Other Construction Craft Workers
Fifteen programs related to this occupational area were identified in the VPO. Supply from only one of those programs, Construction and Building Trades, exceeds projected openings due to growth, including defense impact. The majority of completers of this program are at the secondary level. While many secondary students enroll in and complete this program, a large number of them do so for personal enrichment rather than as preparation for a vocation. Supply data may thus be inflated for this program, rendering statewide supply/demand analysis inconclusive.

Welders and Flamecutters
VEDS data for the program related to this occupation indicate a surplus of trained workers exists. Completers of welding programs outnumber average annual openings due to both growth (including defense impact) and replacement needs for this occupation. While all persons trained in welding do not enter employment in this field (particularly secondary students who may be enrolled in such coursework for personal development rather than vocational preparation), the number of trained persons statewide appears to be adequate to meet demand.

Other Mechanics, Repairers and Installers
The VPO relates thirty-five different programs to this broad occupational category. These thirty-five programs appear to correspond to a variety of industrial work settings and supply a number of different occupations within each. Supply/demand analysis thus proves inconclusive for this occupational area.

Machinists
Supply/demand analysis indicates related training programs provide a surplus of workers qualified to work as Machinists. However, one such program category, Machine Shop, potentially trains workers for a number of occupations. In essence, training program completers would have to be apportioned among these occupational categories in order to match effective supply and demand.

Electricians
VEDS data for programs related to this occupation by the VPO indicate a shortage of trained workers exists. Due to the recent slowdown in construction and manufacturing activity, however, many trained Electricians are unemployed. These Electricians will be available to meet the demand as the economy improves.

Protective Service Workers
Comparing VEDS data with projected average annual openings due to both growth (including defense impact) and replacement needs suggests this occupational area is undersupplied. However, several occupations within this category do not require formal preparation, i.e. training generally occurs on the job. Therefore, supply for this occupational category is likely to be understated.

Conclusions

Although Illinois is limited to a small share of the total national defense spending picture, $1.3 billion is still a relatively large potential source for occupational growth. That figure ($1.3 billion) is more than 10 percent of the total state government expenditures (including education) and is equivalent to approximately 1 percent of the Gross State Product for 1982. Thus, the impact of defense spending upon employment and related training programs is a major concern to those making vocational education and employment decisions.

Looking at the state as a whole, the comparison of occupational supply and demand indicates that for those occupations which will encounter major growth due to defense spending, programs in Business Office Occupations (Secretaries, Typists, Office Machine Operators, and Other Clerical Workers), will require the closest monitoring by educators to meet the employment demand. Analyses of comparisons of supply and demand for the four occupational categories of Assemblers; Other Construction Craft Workers; Other Mechanics, Repairers and Installers; and Machinists were inconclusive due to extraneous factors. Educational planners should, therefore, monitor programs related to these occupational categories just as closely to assess employment developments in these areas.

Regionally, complete supply and demand comparisons were not possible in this study. However, estimates of the occupations which will potentially experience the greatest impact of defense spending were identified. Some regions may be more adequately prepared to meet this impact than others. Vocational planners should be cognizant of the defense contracting in their regions and pay particular attention to the programs related to the identified occupational impact areas.

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APPENDIX A

Illinois Fiscal Year 1982
Defense Contracts by County

Illinois
FY82 Defense Contracts
By County

Contractor	DUNS	City	County	Dollar
Cartech Inc.	046370011	Quincy	Adams	290000
Broadcast Electronics Inc.	000000000	Quincy	Adams	309000
Artcraft Co.	059992487	Quincy	Adams	23000
Dunbar & Sullivan Dredging Co.	006957963	Quincy	Adams	275000
Comstock Castle Stove Co. Inc.	006263065	Quincy	Adams	96000
Harris Corp.	000000000	Quincy	Adams	1618000
Landmark Excavating & Equip. Co.	099671596	Quincy	Adams	598000
Tuscarora Plastics Inc.		Quincy	Adams	60000
Mayer Hammant Equipment Inc.	050906890	Quincy	Adams	14000
County Total				**3274000**
Knobel Redman Construction Co.		Cairo	Alexander	26000
County Total				**26000**
White Sunstrand Machine Tool Inc.	004203642	Belvidere	Boone	1077000
County Total				**1077000**
Strong Oil Co.		Versailles	Brown	17000
County Total				**17000**
Champion Pneumatic Machinery Co.	005214192	Princeton	Bureau	16000
Dix Superior Supply Co.	059872903	Princeton	Bureau	13000
Valley Electromagnetics Corp.	991298712	Spring Valley	Bureau	56000
Schneider L. W.	000000000	Princeton	Bureau	209000
United States Interior Dept.	991295197	Princeton	Bureau	15000
County Total				**309000**
Delta Rail Corp.	099044083	Savanna	Carroll	248000
Dubuque Insulation & Siding Co.	000000000	Savanna	Carroll	319000
Control Data Corp.	000000000	Savanna	Carroll	155000
Carroll County Illinois	991285388	Mt. Carroll	Carroll	11000
Amtrac Railroad Contractors	057525818	Savanna	Carroll	96000
American Combustion Industries SVC	990944795	Savanna	Carroll	21000
Alco Dispensing System	092427541	Savanna	Carroll	203000
Farmers Lumber & Supply Co.	000000000	Savanna	Carroll	12000
Savin Corp.	052076957	Savanna	Carroll	11000
Railroad Builders of Southeast Inc.	096379763	Savanna	Carroll	376000
Welu Painting Co.	991482225	Savanna	Carroll	15000
Woodbury C. F. Co. Inc.	016996415	Mt. Carroll	Carroll	195000
Mahl Robert L. & Storer Ronald	991483819	Savanna	Carroll	23000
Marken & Watters Construction Co.	061048781	Savanna	Carroll	12000
Interstate Power Co.	087267969	Savanna	Carroll	84000
Wienen Bros. Inc.	000000000	Savanna	Carroll	524000
County Total				**2305000**
Bohn Heat Transfer Oil Co.	065247355	Beardstown	Cass	20000
Sinnco Inc.	074075466	Beardstown	Cass	62000
Illinois Glove Co.		Beardstown	Cass	4678000
Robertson Construction Co.	004790002	Chandlerville	Cass	34000
Wong & Associates	054081971	Arenzville	Cass	13000
County Total				**4807000**

Note: This appendix represents the first page of a computer-generated printout of approximately 40 pages in length. The entire printout is available on a cost recovery basis from: Illinois Occupational Information Coordinating Committee, 217 East Monroe, Suite 203, Springfield, Illinois 62706, (217) 785-0789.

APPENDIX B

**Illinois Fiscal Year 1982 Defense Contracts:
Total Dollar Amounts by Defense Related Industry
Number and Region**

Illinois FY82 Defense Contracts
Total Dollar Amount By DRI Number By Region

Region	Description	DRI	Dollar
1	Military Personnel Recruiting	82	697000
1	Oper. of Govt. Fac./Fuel Storage Bldgs.	82	165000
1	Oper. of Govt. Fac./Heating and Cooling Plants	82	141000
DRI Total			**1003000**
1	Vocational-Technical Training	77	
1	RDTE/Other Defense	77	4339000
1	RDTE/Other Research and Development	77	4092000
1	Tuition Fees	77	3018000
1	Other Special Studies and Analyses	77	2532000
1	RDTE/Missile and Space Systems	77	2194000
1	RDTE/Other Medical	77	1963000
1	RDTE/Defense Services	77	1736000
1	Laboratory Testing — Medical	77	834000
1	RDTE/General Sciences and Technology	77	813000
1	Other Medical Services	77	716000
1	RDTE/Fuels and Lubricants	77	627000
1	RDTE/Aircraft	77	509000
1	RDTE/Biomedical	77	497000
1	RDTE/Tank — Automotive	77	436000
1	RDTE/Weapons	77	382000
1	RDTE/Ammunition	77	365000
1	RDTE/Aeronautical Research & Technology	77	150000
DRI Total			137000
			25340000
1	Maint.-Repair of Eq./Engine Accessories	75	
DRI Total			187000
			187000
1	Food Service	74	
DRI Total			656000
			656000
1	Lease-Rental of Eq./ADP Equipment and Supplies	73	
1	Mgt. Services/Systems Engineering	73	7711000
1	Custodial — Janitorial	73	2181000
1	Other ADP Services	73	1201000
1	Mgt. Services/Data Collection	73	1081000
1	Other Architects & Engineering — General	73	718000
1	Maint.-Repair of Eq./Aircraft Components	73	716000
1	Mgt. Services/Program Management-Support	73	636000
1	Studies/ADP Systems	73	532000
1	A/E — Production Engineering	73	530000
1	Lease-Rental of Eq./Subsistence	73	515000
1	Maint.-Repair of Eq./Instruments & Lab Eq.	73	481000
1	Technical Writing	73	454000
1	Guard Services	73	428000
1	Lease-Rental of Eq./Miscellaneous Equipment	73	360000
1	Architect/Engineer — General	73	304000
1	Other Management Services	73	272000
1	Lease-Rental of Eq./Household Furnishings	73	264000
1	Lease-Rental of Eq./Office Machines	73	236000
			214000

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APPENDIX C

**Illinois Fiscal Year 1982 Defense Contracts:
Listings of Federal Supply Codes and Dollar Amounts
by Region and County**

Illinois
FY82 Defense Contracts
Dollar Amount Per FSC

Region	County	Description	Dollar	FSC
1	Cook	A /E — Production Engineering	417000	R215
1	Cook	A/E Construction /Admin. & Svc. Bldgs.	193000	R111
1	Cook	A/E Construction /Other Buildings	108000	R119
1	Cook	A/E Construction /Hospital Buildings	22000	R114
1	Cook	Accounting and Calculating Machines	11000	7420
1	Cook	ADP Accessorial Equipment	726000	7035
1	Cook	ADP Central Processing Unit — Digital	16000	7021
1	Cook	ADP Central Processing Unit — Analog	16000	7020
1	Cook	ADP Components	308000	7050
1	Cook	ADP Input/Output and Storage Devices	306000	7025
1	Cook	ADP Software	178000	7030
1	Cook	ADP Supplies and Support Equipment	436000	7045
1	Cook	ADPE Configuration	50000	7010
1	Cook	Air Conditioning Equipment	29000	4120
1	Cook	Air Passenger Service	382000	V211
1	Cook	Air Purification Equipment	12000	4460
1	Cook	Aircraft Air Conditioning Heating Equipment	100000	1660
1	Cook	Aircraft Gunnery Fire Control Components	15000	1270
1	Cook	Aircraft Hydraulic Vacuum De-icing Comps.	1098000	1650
1	Cook	Aircraft Launching Equipment	50000	1720
1	Cook	Aircraft Maintenance & Repair Shop Equip.	742000	4920
1	Cook	Aircraft Propellers	40000	1610
1	Cook	Aircraft Wheel and Brake Systems	39000	1630
1	Cook	Airframe Structural Components	626000	1560
1	Cook	Ammunition & Nuclear Ordnance Boxes	101000	8140
1	Cook	Ammunition Over 125 MM	97000	1320
1	Cook	Antennas, Waveguides & Related Equipment	892000	5985
1	Cook	Architect/Engineer — General	110000	R211
1	Cook	Armament Training Devices	229000	6920
1	Cook	Athletic and Sporting Equipment	672000	7810
1	Cook	Automatic Pilot Mechanisms Airborne Gyro	217000	6615
1	Cook	Bags and Sacks	1115000	8105
1	Cook	Bakery and Cereal Products	11098000	8920
1	Cook	Ballasts, Lampholders and Starters	106000	6250
1	Cook	Bars And Rods Iron And Steel	112000	9510
1	Cook	Bars And Rods Nonferrous Base Metal	54000	9530
1	Cook	Batteries Primary	17000	6135
1	Cook	Batteries Secondary	124000	6140
1	Cook	Bearings Antifriction, Unmounted	252000	3110
1	Cook	Bearings, Mounted	20000	3130
1	Cook	Bearings, Plain, Unmounted	40000	3120
1	Cook	Bending and Forming Machines	147000	3441
1	Cook	Beverages, Nonalcoholic	1512000	8960
1	Cook	Bolts	108000	5306
1	Cook	Bombs	3438000	1325
1	Cook	Books and Pamphlets	408000	7610
1	Cook	Boring Machines	60000	3411
1	Cook	Bottles and Jars	48000	8125
1	Cook	Boxes, Cartons and Crates	13000	8115
1	Cook	Bridges, Fixed and Floating	353000	5420
1	Cook	Cabinets, Lockers, Bins and Shelving	641000	7125

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APPENDIX D

Crosswalk of Specific Impact Occupations to Unites States Office of Education Programs in Illinois

Crosswalk of Specific Impact Occupations To United States Office of Education Programs in Illinois

Occupations	Programs
Drafters	17.1300 Drafting
Electrical and Electronic Technicians	16.0107 Electrical Technology 16.0108 Electronic Technology 16.0112 Instrumental Technology 17.1501 Communications Electronics 17.1502 Industrial Electronics
Other Engineering Technicians	21 related programs indicated by VPO
Nurses, Professional	07.0301 Nursing (Associate Degree)
Computer Programmers	14.0200 Business Data Processing Systems 14.0203 Computer Programming 16.0117 Scientific Data Processing
Computer Systems Analysts	14.0203 Computer Programming 14.0204 Systems Analysis
Computer and Peripheral Equipment Operators	14.0201 Computer and Console Operations 14.0202 Keypunch, Coding and Peripheral Equipment Operations *
Secretaries, Typists, and Other Office Machine Operators	14.0104 Machine Operation 14.0301 Duplicating Machine Operations 14.0303 General Office Clerking 14.0404 Mail-Preparing and Mail-Handling Operations 14.0701 Executive Secretary Science 14.0702 Secretarial 14.0703 Stenography 14.0901 Clerk-Typist 14.0902 Typists
Other Clerical Workers	16 related programs indicated by VPO
Electricians	17.1002 Construction Electricity 17.1400 Electrical Occupations 17.1401 Industrial Electrician 17.1402 Line Worker 17.1403 Motor Repair
Plumbers and Pipefitters	17.1007 Plumbing and Pipefitting
Structural Steel Workers	17.1099 Industrial Maintenance 17.2304 Combined Metal Trades
Other Construction Craft Workers	15 related programs indicated by VPO
Aircraft Mechanics	16.0101 Aeronautical Technology 17.0401 Aircraft Maintenance 17.1403 Motor Repair 17.2101 Instrument Repair
Automotive Mechanics, and Repairers	17.0100 Air Conditioning 17.0300 Automotive Services 17.0301 Body and Fender 17.0302 Mechanics 17.0303 Specialization

*Keypunch only according to DAVTE Occupational Consultants

Occupations	Programs
Millwrights	17.1099 Industrial Maintenance
Telephone Installers and Repairers	17.1401 Industrial Electrician 17.1402 Lineman 17.1501 Communications Electronics
Other Mechanics, Repairers and Installers	35 related programs indicated by VPO
Forging Press Operators	17.2304 Combined Metal Trades
Machine Tool Setters, Metalwork	17.2301 Foundry 17.2302 Machine Shop 17.2303 Machine Tool Operations (semi-skill) 17.2304 Combined Metal Trades 17.2305 Sheet Metal
Machinists	17.2200 Maritime Maintenance and Services 17.2302 Machine Shop
Molders, Metal	17.2301 Foundry 17.2307 Tool and Die Making
Patternmakers, Metal	16.0109 Electromechanical Technology 16.0111 Industrial Technology 17.0401 Aircraft Maintenance 17.2302 Machine Shop 17.2307 Tool and Die Making 17.2309 Metal Patternmaking
Sheetmetal Workers	17.0401 Aircraft Maintenance 17.2304 Combined Metal Trades 17.2305 Sheet Metal
Tool and Diemakers	17.2302 Machine Shop 17.2307 Tool and Die Making 17.2308 Die Sinking
Printing Trade and Craft Workers	17.1900 Graphic Arts 17.1901 Composition, Make-up and Typesetting 17.1902 Printing Press Operation 17.1903 Lithography, Photography and Platemaking 17.1904 Photoengraving 17.1905 Silk Screen Making and Printing 17.1906 Book Binding
Assemblers	20 related programs indicated by VPO
Drill Press Operatives	17.2303 Machine Tool Operations (semi-skill)
Electroplaters	17.2399 Other Metalworking Occupations **
Grinding Machine Operatives	17.2301 Foundry 17.2303 Machine Tool Operations (semi-skill) 17.2307 Tool and Die Making
Lathe Milling Machine Operatives	17.2303 Machine Tool Operations (semi-skill) 17.2304 Combined Metal Trades 17.3601 Millwork and Cabinet Making
Punch Press Operators, Metal	17.2303 Machine Tool Operations (semi-skill) 17.2304 Combined Metal Trades 17.2305 Sheet Metal

**Not an Illinois O.E. code.

Occupations	Programs	
Welders and Flamecutters	17.2306	Welding
Other Metalworking Operatives	17.2301	Foundry
	17.2302	Machine Shop
	17.2303	Machine Tool Operations (semi-skill)
	17.2306	Welding
Food Service Workers	04.0700	Food Services
	09.0203	Food Management, Production, and Services
Health Service Workers	07.0101	Dental Assisting
	07.0301	Nursing (Associate Degree)
	07.0302	Practical Nursing
	07.0303	Nurse Aide
	07.0304	Psychiatric Aide
	07.0306	Obstetrical Technician
	07.0307	Home Health Aide
	07.0401	Occupational Therapy Aide
	07.0404	Orthotics
	07.0904	Medical Assisting
	07.0905	Central Supply Technology
	07.0907	Emergency Medical Technology
Protective Service Workers	17.2801	Fire Prevention and Control
	17.2802	Law Enforcement

APPENDIX E

Distribution of Contract Dollars for Defense-Related Industries Affecting Specific Impact Occupations by Region

Distribution of Contract Dollars for Defense Related Industries Affecting Specific Impact Occupations by Region (in thousands)

	State	REGION 1	2	3	4	5	6
Drafters	$1,097,536 100%	$644,942 59%	$193,888 18%	$42,627 4%	$55,438 5%	$137,317 13%	$23,324 2%
Electrical and Electronic Technicians	1,087,231 100%	638,213 59%	193,405 18%	42,479 4%	53,226 5%	137,317 13%	22,591 2%
Other Engineering Technicians	1,228,050 100%	762,479 62%	198,641 16%	44,292 4%	60,772 5%	138,542 11%	23,324 2%
Nurses, Professional	812,868 100%	536,448 66%	162,704 20%	29,256 4%	22,104 3%	50,589 6%	11,767 1%
Computer Programmers	1,212,528 100%	751,367 62%	196,730 16%	44,582 4%	60,524 5%	136,460 11%	22,865 2%
Computer Systems Analysts	1,093,804 100%	644,929 59%	191,977 18%	42,479 4%	55,493 5%	136,061 12%	22,865 2%
Computer and Peripheral Equipment Operators	1,243,931 100%	768,156 62%	198,597 16%	45,410 4%	61,141 5%	142,459 11%	28,168 2%
Secretaries, Typists, and Other Office Machine Operators	1,310,163 100%	804,954 61%	203,932 16%	47,692 4%	66,623 5%	157,620 12%	29,342 2%
Other Clerical Workers	1,310,757 100%	805,548 61%	203,932 16%	47,692 4%	66,623 5%	157,620 12%	29,342 2%
Electricians	1,242,039 100%	766,581 62%	198,815 16%	45,558 4%	61,334 5%	141,583 11%	28,168 2%
Plumbers and Pipefitters	1,187,583 100%	740,722 62%	193,118 16%	44,007 4%	60,103 5%	131,604 11%	18,029 2%
Structural Steel Workers	553,461 100%	223,676 40%	141,028 25%	27,872 5%	29,619 5%	112,953 20%	18,313 3%
Other Construction Craft Workers	1,262,242 100%	787,112 62%	198,487 16%	45,558 4%	61,334 5%	141,583 11%	28,168 2%
Aircraft Mechanics	556,101 100%	351,116 63%	125,987 23%	7,398 1%	13,463 2%	54,360 10%	3,777 1%
Auto Mechanics and Repairers	1,107,634 100%	670,504 61%	171,152 15%	43,867 4%	62,441 6%	136,673 12%	22,997 2%
Millwrights	1,052,614 100%	634,503 60%	184,020 17%	44,107 4%	46,182 4%	121,603 12%	22,289 2%
Telephone Installers and Repairers	25,902 100%	21,216 82%	110 0.4%	-0-	-0-	4,576 18%	-0-
Other Mechanics, Repairers and Installers	1,230,277 100%	757,751 62%	193,387 16%	45,120 4%	63,688 5%	142,295 12%	28,036 2%

Distribution of Contract Dollars for Defense Related Industries Affecting Specific Impact Occupations by Region (in thousands)

(continued)

	State	REGIONS 1	2	3	4	5	6
Forging Press Operators	$523,755 100%	$351,612 67%	$95,181 18%	$22,575 4%	$8,981 2%	$41,468 8%	$3,938 1%
Machine Tool Setters, Metalwork	764,496 100%	486,662 64%	164,871 22%	39,367 5%	23,826 3%	45,373 6%	4,397 1%
Machinists	1,290,154 100%	799,024 62%	198,815 15%	45,558 4%	64,129 5%	154,460 12%	28,168 2%
Molders, Metal	673,688 100%	408,260 61%	154,457 23%	39,367 6%	23,633 4%	44,294 7%	3,677 1%
Patternmakers, Metal	495,498 100%	309,665 62%	130,992 26%	3,320 1%	4,319 1%	43,535 9%	3,677 1%
Sheetmetal Workers	1,024,963 100%	590,923 58%	190,944 19%	41,838 4%	50,995 5%	128,731 13%	21,532 2%
Tool and Diemakers	857,831 100%	526,609 61%	180,363 21%	40,903 5%	28,951 4%	65,496 8%	15,509 2%
Assembers	808,262 100%	507,031 63%	172,395 21%	39,515 5%	25,845 3%	58,214 7%	5,262 1%
Drill Press Operatives	742,076 100%	468,491 63%	164,995 22%	39,367 5%	23,633 3%	41,193 6%	4,397 1%
Electroplaters	611,502 100%	404,663 66%	145,468 24%	7,935 1%	5,581 1%	43,917 7%	3,938 1%
Grinding Machine Operatives	741,952 100%	468,491 63%	164,871 22%	39,367 5%	23,633 3%	41,193 6%	4,397 1%
Lathe Milling Machine Operatives	737,804 100%	464,560 63%	164,995 22%	39,219 5%	23,440 3%	41,193 6%	4,397 1%
Punch Press Operators, Metal	762,214 100%	488,213 64%	165,279 22%	39,367 5%	23,633 3%	41,193 5%	4,529 1%
Welders and Flamecutters	1,107,703 100%	653,234 59%	193,902 17%	42,337 4%	57,985 5%	136,921 12%	23,324 2%
Other Metalworking Operatives	622,577 100%	394,787 63%	149,884 24%	27,808 4%	8,050 1%	39,177 6%	2,871 0.4%

APPENDIX F

Illinois Vocational Education Regions Map

Illinois Vocational Education Regions